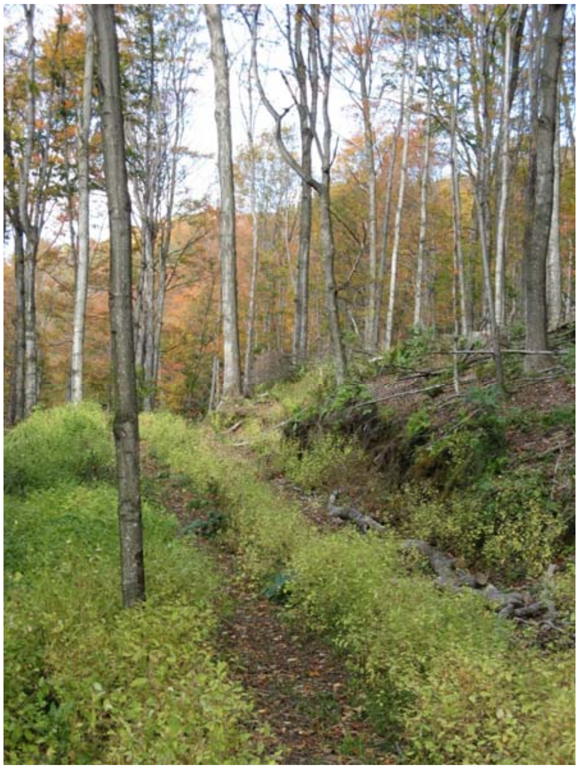
HEALTHY WATERSHEDS ~ HOME WOODSHEDS PROJECT

Conserving Water Quality While Harvesting More Forest Biomass in the Headwaters of the Five-Town Forest



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Abstract

Global climate change and peaking oil supplies are creating a need for alternative sources of energy. Regionally, forest biomass may offer a partial solution if the forestry is ecologically sustainable. Water quality conservation is an essential ingredient of ecologically sustainable forestry. Best Management Practices (BMPs) for maintaining water quality have been repeatedly shown to be very effective when fully implemented. We assessed eight forests in northeast Addison County, Vermont for compliance with the *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont* (AMPs) and interviewed the respective landowners. Our forest assessments revealed that AMP compliance levels ranged from a low of 29% for truck roads to a high of 70% for stream and surface water protective strips. Discussions with landowners revealed low awareness of the AMPs and a lack of recognition that non-compliant practices on individual forests can compromise water quality on a watershed scale. Many landowners identified financial constraints as preventing them from achieving optimal ecological stewardship. All landowners expressed a strong commitment to the long-term health of their forests including increased compliance with the AMPs. We suggest a community-based cooperative to: address educational needs, develop economic opportunities, and cultivate community awareness and support for achieving higher levels of AMP compliance while harvesting more forest biomass in the Five-Town Forest.

Introduction

The Changing Global and Regional Context

Climate Change and Peak Oil

Changing climatic conditions will continue to create unforeseeable environmental, social, and economic impacts (IPCC, 2007; Karl and Trenberth, 2003). Projected changes include an increase in average global air temperatures, a rise in sea levels, and more extreme weather events—each of these will have significant associated socio-economic consequences (IPCC, 2007; Parmesan, 2006; Karl and Trenberth, 2003).

The climate crisis is a global issue, but its effects can be felt in our own backyard. New England has already seen higher mean annual temperatures, increased rainfall, and more intense storms and has witnessed their ecological and economic repercussions. (Stager and Thill, 2010; Foster et. al, 2010). It is anticipated that headwater tributary systems will be especially affected including earlier ice jams and flooding, lower stream oxygenation levels, less habitat for cold-water species, increased nutrient inputs, more soil erosion and sedimentation, and disruption of streambed habitat (Stager and Thill, 2010). These environmental changes will have corresponding health and economic affects such as the increased risk of water-borne infections or diseases resulting from flooding and/or warming (McMichael et. al, 2006; NCDC, 2010).

Diminishing fossil fuel supplies add even more urgency to the climate question. *Peak oil* is “the point when further expansion of oil production slows because new production flows are fully offset by production declines” (Hopkins, 2009). Studies suggest that we have passed this tipping point and that half of the oil reserves are used up (Hopkins, 2009; Bridge, 2010).

Substituting Forest Fuels for Fossil Fuels

One alternative proposed to address climate change while reducing dependence on fossil fuels is the burning of forest biomass (BERC, 2007). The Biomass Energy Resource Center (BERC) has advocated burning forest biomass using wood chip gasification systems, stating that "this technology offers improvements in fuel efficiency as well as the potential of lower costs and better environmental performance than conventional heating oil or wood combustion" (BERC, 2007). It has been suggested that by using wood 'wastes' obtained from sustainable forestry practices, it is possible to stabilize greenhouse gases while also increasing forest health (BERC, 2007).

Wood currently supplies roughly 6% of Vermont's electrical and heating demand (Department of Public Service, 2000; VT FP&R, 2010). Mount Abraham Union High School and Middlebury College recently elected to switch from burning #6 fuel oil to using forest biomass (Env. Studies Senior Seminar, 2009; Cusack, 2007). In 2009, Middlebury opened a $12 million biomass gasification system that burns over 20,000 green tons of woodchips annually. This supplies over half of the College's heating requirements, is roughly equivalent to 8,000 cords of wood, and represents about 80% of the estimated annual growth of suitable additional wood that could be harvested in the Five-Town Forest (Lapin et al. 2009). By comparison, the Mt. Abe biomass plant requires 900 green tons of woodchips and has a heating capacity of 1.8 MW (6 MMBtu/hr) (BERC, 2007).

The Need For Ecologically-Sustainable Forestry

Though wood fuel could be a promising solution or at least one part of the transition away from global fossil fuels, we must also consider the sustainability of the associated harvesting methods (Env. Studies Senior Seminar, 2009). Middlebury College is in the process of developing a wood chip procurement policy to address concerns over the sustainability of the harvesting.

Less than four hundred years ago, forests comprised over 90% of the landscape in New England. But during the 18th century, colonists began converting primeval forestland to farmland (see Figure 1). This eventually resulted in an unsustainable rural economy and an emerging industrial landscape (Foster et. al, 2010; Whitney, 1994). Much of the clear-cut land became eroded, and sediment was deposited into streams and rivers. Farm abandonment during the mid 19th century allowed forests to return. Partially in response to the recovery from the impacts of deforestation, the region emerged as a pioneer in conservation and this remains an important part of its identity (Foster, et. al, 2010). The forests are still recovering from these past abuses.

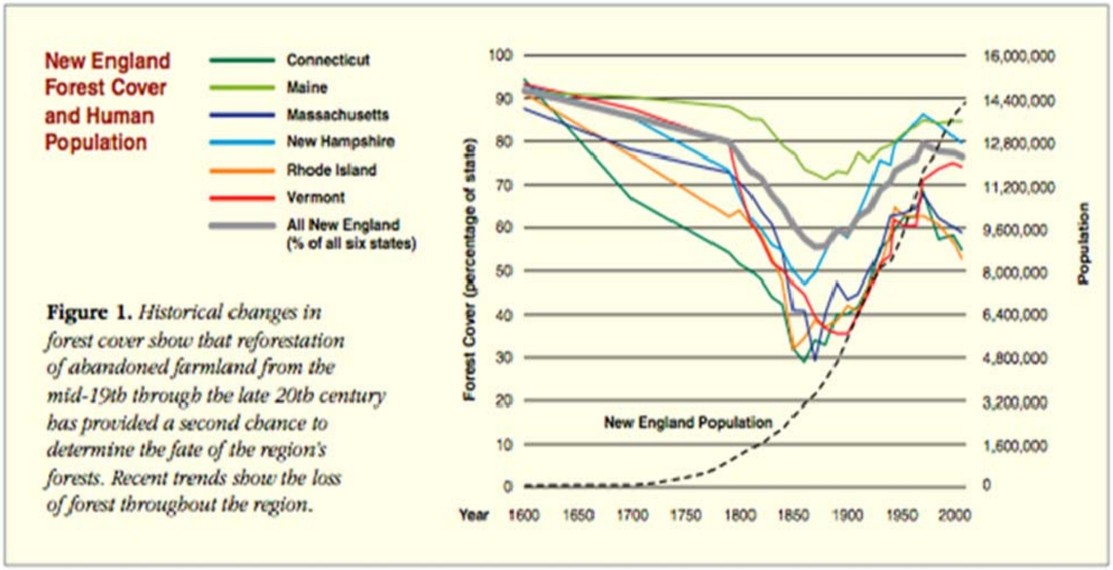


Figure 1. Historical trends in Forest Cover in New England from Foster et. al, 2010.

High water quality and prime physical habitats—that support species such as the native brook trout—have returned to much of Vermont. (Kirn, 2007; Lapin et al, 2009). Seventy-eight percent of Vermont is now covered by trees, water, and wetlands, which offer recreation, hunting, forest products, community uses, habitat corridors, and a globally-important source of renewable energy and carbon storage (VT FP&R, 2010). Vermont contains a total of 4.46 million acres of forestland, 4.35 million of which the USDA Forest Service has classified as timberland, or “land fertile and accessible for producing wood as a crop.” The forest industry contributes over $1.5 billion annually to Vermont’s economy, providing employment for 6,379 people, and generating a payroll of over $207.4 million (VT FP&R 2010). Eighty-one percent of timberland in the state is privately owned (VT PP&R, 2010).

Despite its potential as a sustainable and renewable energy alternative, increased harvesting and impacts of biomass removal could place a significant demand on our forest ecosystems. Increased biomass removals can impact water quality, soil erosion, nutrient cycling, and habitat (Perry, 2008). Land health, as defined by Aldo Leopold, is “the capacity of the land for self-renewal” (Leopold, 1949). Conserving land health while harvesting more forest biomass requires effective forest management and sustainable biomass harvesting to protect the forest’s ecological functions and values (Perry, 2008).

Vermont’s forest industry is faced with increasing challenges resulting from global competition, high energy costs, high insurance costs, and recruitment and retention of workers (VT FP&R, 2010). Responding to the proliferation of biomass in Vermont has been a struggle among forest conservationists as well as economically-driven timber industries. Forest biomass removals have historically been subsidized by the removal of higher-value timber products (BERC, 2007). Until very recently, forest biomass harvesting was also subsidized by the Biomass Crop Assistance Program (BCAP) where qualified producers received up to $55 per cord for biomass feedstocks (BCAP, 2010). There were no harvesting standards associated with these incentives.

In order to conserve the health of our ecosystems while extracting more biomass, Vermont Family Forests (VFF) proposed the SELF model in 2004. This model suggests that the harvesting and use of forest biomass for fuel be ecologically sustainable (S), energy efficient (E), local (L), and fair (F) to all of the players (VFF, 2004). VFF has also adopted a Forest Conservation Checklist which contains recommended forestry practices (VFF, 2010).

Sustainable forestry practices in New England could play an important role in helping to ensure a steady supply of high quality wood products, while also supporting shared environmental and community values (Colburn, 2004). Ecological forestry places an emphasis on natural processes and patterns: “understanding them, working in harmony with them, and maintaining their integrity, even when it becomes financially difficult or inconvenient to do so” (Seymour, 1999). However, ecological forestry is more expensive than production forestry (Seymour, 1999; McEvoy, 2004).

Among the economic difficulties associated with climate change, peak oil, and the substitution of sustainable forest fuels for fossil fuels is the need for internalizing more of the associated costs (Goodstein, 2008). Despite evidence of environmental and health impacts associated with burning fossil fuels, the associated ecological costs are not fully accounted for in market prices (Goodstein, 2008; Guest, 2010). Substituting forest fuels for these artificially low-priced fossil fuels presents a significant challenge. Without economic incentives to support ecological forestry, we could destroy the vital functions of our forest ecosystems in the name of “green energy” (Perry, 2008).

Conserving Water Quality in Forested Watersheds

Initiated in 1994, the Montréal Process was designed to "conserve and promote sustainable forest management practices in boreal and temperate forest ecosystems" (Ritter et al., 2004). One of the seven criteria of the Montréal Process included the conservation of water quality in actively managed forest watersheds. (Ritters et al., 2004).

Healthy, forested watersheds provide high-quality water supplies by regulating stormwater runoff and sediment discharge (Barten, et. al, 2010). However, in addition to direct climate impacts, the hydrology of forested watersheds could be compromised by unsustainable harvesting of forest biomass as an alternative fuel supply (Calder, 2007). Forest disturbance and human alterations can affect forest structure, water flow paths in soil and subsoil, and water chemistry.

Water quality has been recognized as being a key indicator of the ecological sustainability of the practices associated with forest biomass fuel removal (Forest Guild, 2010). Water quality and aquatic ecosystems can be detrimentally affected by harvest activities, and more intensive harvesting has led to increased sedimentation, woody debris deposition, leaching of nutrients into streams, and increased diurnal ranges of stream temperatures (Phillips et. al, 2000; Pierce et al., 1993). Best Management Practices (BMPs) were developed to prevent or minimize harmful effects of forest harvesting activities on water quality (Phillips et. al, 2000). BMPs recommend greater care, reduced physical disturbance (e.g., ski trails, roads, equipment) especially in the riparian buffer zones, and ample pre-harvest planning. Research suggests that BMPs are highly effective in preventing sediment and petroleum discharges and increases in diurnal stream temperature ranges when they are fully applied during and maintained after timber harvesting operations (Phillips et. al, 2000; Briggs et al., 1998)**.**

In an effort to conserve water quality nationwide, the federal government passed the Clean Water Act (CWA) in 1972 (EPA, 2010). In 1986, the Vermont Legislature passed amendments to Vermont's water quality statutes, which called for permits to discharge "any waste, substance or material into the waters of the state" (VT ANR 2009; AMP statewide summary, 2009). The following year, *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont* were developed and accepted as rules to Vermont's water quality statues. The AMPs consist of scientifically-proven approaches for loggers and landowners to promote the long-term upgrade of water quality (VT ANR, 2009). They are intended to prevent mud, petroleum and woody debris (logging slash) from entering our watersheds (VT FP&R, 1987).

In 2003, Vermont initiated the Clean and Clear Water Plan with the goal of reducing pollutants in waters statewide. The state appropriated more than $42 million for Clean and Clear over the first five years of this effort. Vermont's commitment to Clean and Clear has stimulated an additional $42 million in federal funds for supporting programs. In general, these programs are designed to better manage the landscape to preserve water quality and vary in scope from grants aimed to improve backroads through the Better Backroads Grants Program to those targeted at stormwater management.

Of particular importance to our study is the Forest Watershed Management section of the Clean and Clear Plan. The language of the action plan acknowledges that Vermont's forests protect municipal water supplies, reduce flooding, replenish groundwater aquifers, provide recreation and critical fish and wildlife habitat, yield numerous wood products, and store carbon. Yet, poor forest management can compromise these functions. A 2004 report from the Lake Champlain Basin Program estimated that 8-15% of the total non-point source phosphorus load delivered to Lake Champlain comes from forestland (Lake Champlain Basin Atlas, 2004).

To encourage more sustainable management, VT Clean and Clear's Watershed Forestry Program focuses efforts on education, outreach, and technical assistance to forest landowners, loggers, forestry professionals and the general public (VT ANR 2009). Specifically, Vermont's Agency of Natural Resources (ANR) and Department of Forests, Parks and Recreation (FP&R) have worked to improve AMP compliance. Examples of this include the Portable Skidder Bridge Program, Vocational Forestry Program and Logger Education to Advance Professionalism Program (VT ANR, 2009; VT FPR, 2010).

Conserving Forest Water Quality in the Local Context

"Find your place on the planet, dig in, and take responsibility"
(Gary Snyder, 1974)

If local biomass production increases while being sustainably harvested, we can alleviate development pressure, reduce dependence on imported wood, and have less of an impact on the environment, both globally and locally (BERC, 2007). Focusing on impacts at the community level can help to address common problems that arise in a region and can allow for benefits from unique opportunities (Barten, et. al, 2008). The Five-Town Forest (FTF) is a collection of privately- and publicly-owned woodlots located throughout Bristol, Lincoln, Starksboro, Monkton and New Haven. Forests make up 60% of the land in this region (Lapin et al, 2009). A map of the Five-Town Forest can be found on page 16 that shows the area of forest cover in the Five-Town Forest.

Vermont Family Forests found that 37,900 acres of this forestland is considered to be suitable and available for sustainable forest biomass harvesting and extraction (Lapin et. al, 2009). This suitability is based on slope, elevation, soils, and surface waters and wetlands with adjacent 75 foot buffers. Based on the range of growth rates and quality of wood in the region, growth rate in the suitable woodshed was then estimated to be approximately 17,000-37,000 green tons/year (Lapin et. al, 2009). Eighty-four percent of the suitable woodshed is privately owned.

Local Economic Constraints

Vermont Family Forests prepared a Biomass Fuel Assessment in 2004 suggesting that, with sustainable forestry practices**,** Addison County (as a proxy for the FTF) could not meet the increasing demands of biomass from the college and local residences (VFF, 2004). Operators of high-quality logging jobs also report that they cannot pull out low-quality material sustainably without losing money (VFF, 2004). Costs for cutting low-quality wood and moving it to a log landing using sustainable procedures were estimated to be about $35-$40 per ton and chips could only be sold for about $30 per ton delivered (VFF, 2004). Although there are current economic constraints in dealing with climate change and biomass extraction, it will ultimately be less costly and more effective to act today rather than trying to respond after the fact (Stager and Thill, 2010).

Watersheds in the Five-Town Forest

An abundance of small streams run through the uplands of the Five-Town Forest, representing the "headwaters areas" of the New Haven and Huntington Rivers, and the Little Otter and Lewis Creek watersheds. Improperly managed timber extraction activities near headwater streams create non-point sources of sediment as well as slash and petroleum that can pollute downstream rivers and lakes. This pollution, especially sediment, decreases water quality for fish and other stream animals and plants. Many of these impacts are not easily detectd becaue they often are storm related (Barten et. al, 2008).

Hydrologic Responses to Poor Logging Practices

The hydrologic responses to forest disturbance include changes in watershed outputs, flooding extent, low-flows, sediment production, water chemistry, and diurnal temperature ranges (Barten et. al, 2008). Flood events, caused by storms, as well as rising water levels, increased hillside run-off, soil erosion, and increased turbidity are a serious risk to human life and property. For instance, the property damage associated with one flood event along the shore of Lake Champlain during May of 1993 was estimated to be $500,000 in Addison County (NCDC, 2010). Damage from the entire flood episode was estimated to be over $1 million across Vermont (NCDC, 2010).

Native Brook Trout in Vermont

The study of wild brook trout populations in Vermont suggests that native brook trout respond directly to changes in stream temperature ranges, sediment, and in-stream habitat, and that water pollution and impurities from poor logging practices in the past were largely responsible for the depletion of these trout populations (Kirn, 2007). Vermont Family Forests

(VFF) has been working to address this issue by raising public awareness and offering education to members of the community. The VFF website (www.familyforests.org) offers a guide book to forest health assessment, for those interested in taking an active role in maintaining a healthy forest. The guide is intended for local community members to help protect water quality, site productivity, native biological diversity, and carbon sequestration and storage.

Acceptable Management Practices (AMPs)

Low levels of compliance with AMPs and poor harvesting practices can degrade water quality (Newton et. al, 1990). When in full compliance, the AMPs offer a way for landowners within the Five-Town Forest to minimize their negative effects on water quality while extracting forest biomass. The AMPs take into account the slope of the land with different measures or requirements for steeper slopes. For example, one rule states that “steep pitches (greater than 10% on permanent roads) shall not exceed a slope of 10 % over a 300 ft distance.” GIS analysis suggests that steep terrain is widespread throughout the Five-Town Forest (see page 18). Lack of compliance has resulted in substantial environmental degradation.

The Healthy Watersheds ~ Home Woodsheds Project

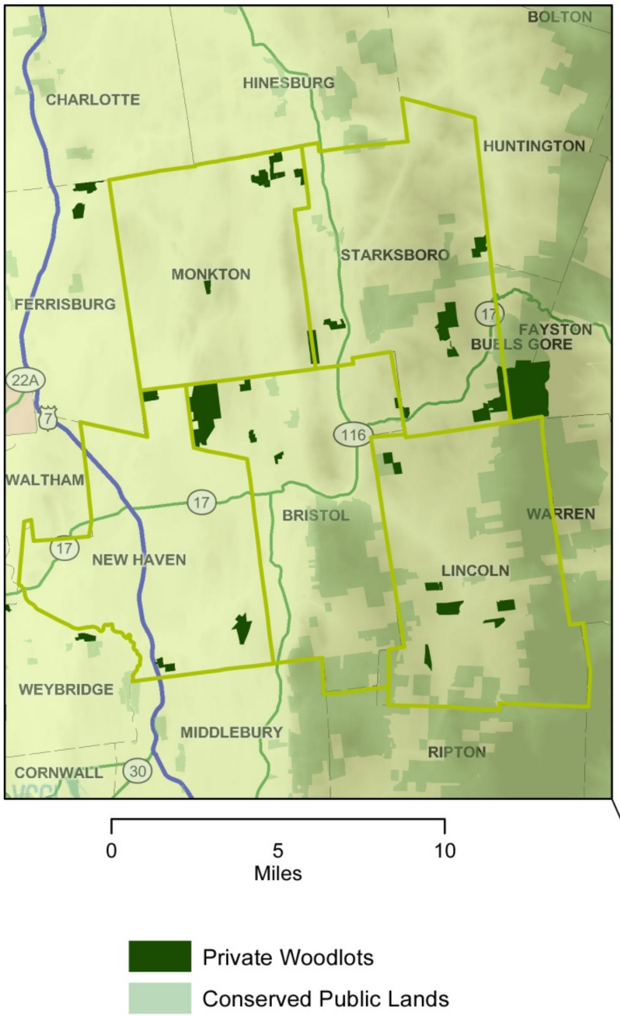
Overview

Within this global and local milieu, it is our hope to develop a comprehensive forestry plan to maintain water quality while supporting biomass harvest within the Five-Town Forest. Water quality is a vague term, dependent on the uses of a specific body of water. For example, though *E. coli* levels are a prime concern to a municipal water supply, it is essentially unimportant to a farmer irrigating a field. The streams within the Five-Town Forest serve a variety of needs, including recreation, limited irrigation, and drinking water.

To sharpen our terms, we will consider water quality to be an extension of *watershed* quality. In our model, the quality of a stretch of stream is dependent primarily upon its ecosystem benefits. We consider a stream healthy or unhealthy based on its ability to support native species of fish and insects and its interaction with the surrounding forest. In general, healthy streams within the Five-Town Forest are those which most closely mimic their natural state with wide forested buffer strips that result in reduced diurnal stream temperature fluctuations and low sedimentation.

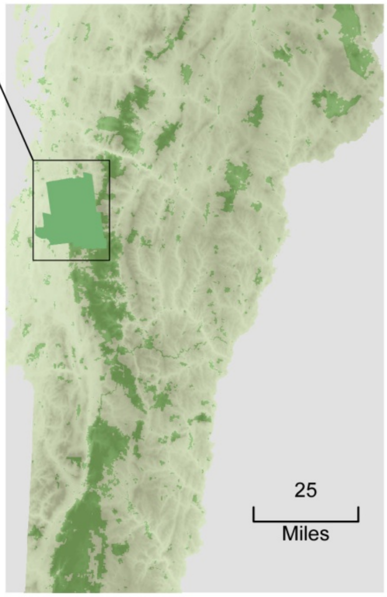
High quality watersheds benefit the flora and fauna of their ecosystem, as well as the health and happiness of the humans who interact with the system. The program RiverWatch, in conjunction with the University of Vermont, has monitored the New Haven River, Lewis Creek, and the Little Otter Creek—all streams within the Five-Town Forest—since the early 1990s (ACRWC, 2010). The waterways of the Five-Town Forest area provide trout habitat and attract fisherman from across the state (ACRWC, 2010). Brown, brook, and rainbow trout inhabit the cool, clear waters of the New Haven River, Baldwin Creek, Lewis Creek, the Little Otter Creek, the Huntington River and other feeder streams of the area. In addition to pathogens and nutrient pollution, the watersheds of the Five-Town Forest carry elevated sediment loads (ACRWC, 2010). The sand, silt, and gravel that erode from the headwater region of the forest create alluvial fans, gravel bars, and property-consuming streambank cutting in the lower reaches of the New Haven River (ACRWC, 2010).

Unlike many other states, which require compliance with best management practices (BMPs), Vermont has relied on a system of voluntary adherence to the AMPs. Landowners are responsible for maintaining the AMPs on their roads and trails but are not actively monitored for compliance. Only when a discharge is reported—often a neighbor noticing a stream running muddy, slick with petroleum, or filled with slash—is a landowner investigated. As long as no discharge is reported, a logging job can be entirely out of AMP compliance with little threat of legal action. Even in the case when a discharge is detected, an Agency of Natural Resources Technical Advisory Team works to aid landowners in addressing the problem before levying fines. In 2009, AMP foresters conducted site investigations on forty-seven logging operations, all of which were brought into compliance without legal ramifications.



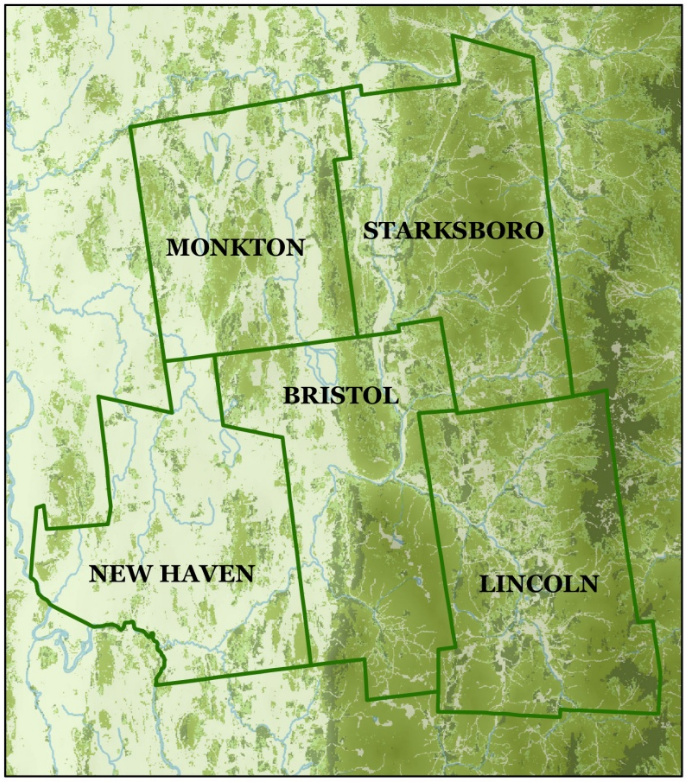
The Five Town Forest

The Five Town Forest is a collection of privately and publicly owned woodlots in Bristol, Lincoln, Starksboro, Monkton and New Haven. Public forest land is split between State Forest and National Forest, while area landowners hold the remaining private land.



FOREST TYPE

🟩 Deciduous
🟩 Coniferous
🟩 Mixed Forest



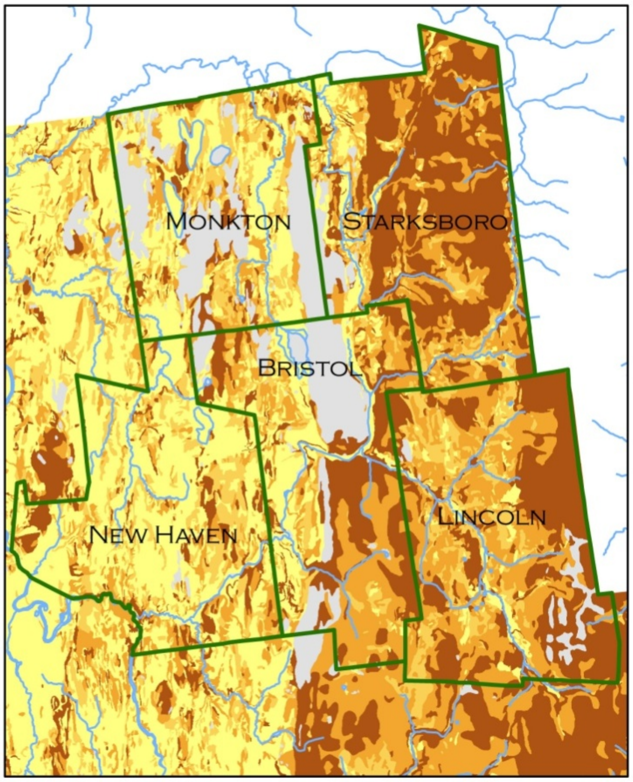
(Margins of Spruce-Tamarack Swamp in the Starksboro Town Forest)

The Five Town Forest consists primarily of deciduous or mixed forest stands, with some conifers on higher, steeper slope aspects. Woodlots in the Five Town Forest have been traditionally managed as sugarworks, heavy on maple. These areas have been occasionally logged, as has most of the forest. The Five Town Forest is a landscape of regrowth, and it is our goal to properly balance water quality and increased forest biomass extraction.

SLOPE ASPECT

The Five Town Forest is a mountainous area, and the majority of its logging jobs occur on steep terrain. Like the photo below, which looks from a steep escarpment in the Starksboro Town Forest toward the Hogback, the region's woodlots often lie on steep terrain that abuts fertile river valleys.

Logging on steeper terrain (especially in excess of 20 percent grade), is likely to compromise water quality through sedimentation. Soils become less stable without vegetation, and road construction on these slopes allows for rapid draining in high flow events.

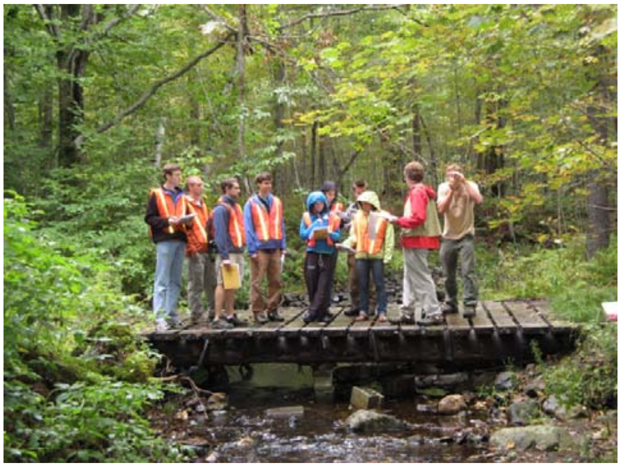


Percent Slope

▨	2 - 8
▨	9 - 15
▨	16 - 30
▨	31 - 50

Research Methods

To gather information we met with local experts, searched the literature, drew upon our own backgrounds in the field of Environmental Studies, and worked with our local project partners—Vermont Family Forests and the conservation commissioners of the five towns. Site visits conducted around the Five-Town Forest included: visiting a section of Camel's Hump State Forest that is actively being harvested with Statelands Forester Michael Johnson; observing Brook Trout populations in the Beaver Meadow Brook with Rich Kirn, Fisheries Biologist with the Vermont Department of Fish & Wildlife; touring the Waterworks, a property with exemplary AMP compliance; and visiting our landowners' forests. We also conducted AMP compliance assessments on eight forested properties in the Five-Town Forest and interviewed the respective landowners.



AMP Compliance Assessment

To determine the compliance of each parcel with the *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont* (VT FP&R, 1987), we assessed five elements: truck roads; log landings; skid trails; stream crossings; and stream and surface water condition. We evaluated whether or not the skidder trails, truck roads, and log landings had the requisite number of water drainage structures based on the grade (slope). In addition, we determined if the roads and log landings were far enough away from any body of water as prescribed in the AMPs. Also, we recorded the worst soil erosion level in a given access segment and the effectiveness of the existing erosion control structures.

Truck Roads

The criteria examined for truck roads were: the number of functional and recommended drainage structures (FDS, RDS); protective and recommended strip width (PSW, RSW); presence or absence of silt fencing and hay bale checks (CHECKS); the worst surface erosion detected by segment (SET); soil drainage (DRAIN); trail segment average slope (GRADE); presence or absence of segments longer than 300 feet and steeper than 10% (STEEP). We inspected truck roads starting from the main log landing to the public road. The first segment measured was two chains (i.e. 132 feet) and segments thereafter were eight chains (528 feet) in length.

Functional Drainage Structures

A total of seven truck roads were assessed on the eight studied properties. The majority of the truck road segments (65%) had grades of 0-10% (Figure 2a). Only 11% of the observed segments at the 11-15% grade interval were in full compliance (Figure 2b). The compliance with erosion control recommendations increased with percent grade of road segment. However, the percentage of truck road segments compliant with drainage structure recommendations is low. None of the truck road segments in the 0-10% grade interval were compliant with drainage structure recommendations. Additionally, several truck road segments exceeded 10% grade for more than 300 feet in length.

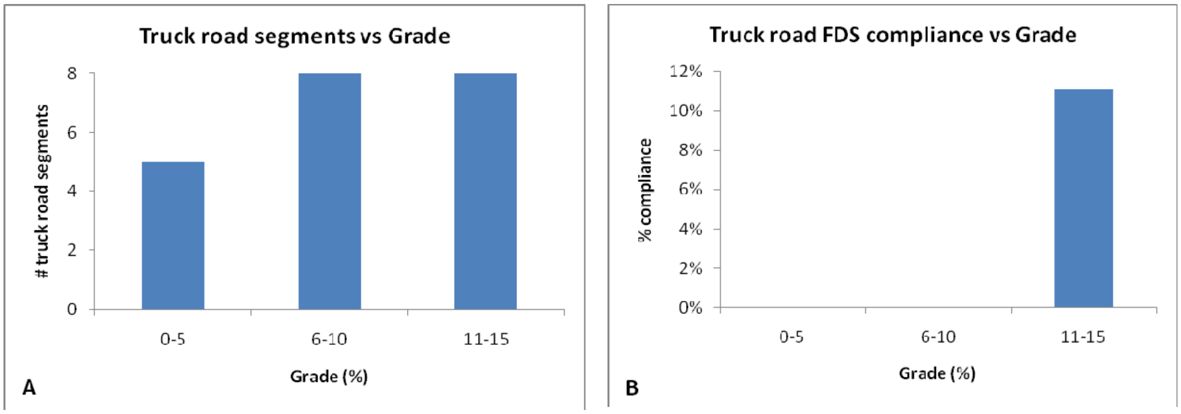


Figure 2a. The number of truck road segments by percent grade. **2b.** The percentage of truck roads in full compliance with AMP drainage structure recommendations.

Protective Strip Width

The seven truck roads had variable AMP compliance levels for protective strip width. While three of the roads had perfect compliance, three ranged from 0 to 75% compliant. In instances of low compliance, it would appear to be important to maintain sediment diversion structures or checks. However, checks were not installed on any of the evaluated properties.

Landings

The criteria we measured for the main landings included: landing size in acres (SIZE); landing percent slope (SLOPE); location within stream or waterbody protective strip (STRIP); presence of oil spills (OIL); sediment diversion installation (G/D); landing seeded and mulched (SEED); worst surface erosion type (SET: ‘1’= sheet, minute rills present; ‘2’= rills up to 6” deep; ‘3’= 6-12” gullies); and soil drainage (DRAIN: poorly drained, moderately well drained, well drained). Most of the properties had relatively small landings (< 0.25 ac.) while one property had a rather large landing (0.88 ac.; Table 1). The slopes were very moderate with none steeper than 4.6% and most from 1 to 2%. Landings generally had very good drainage—except for one, the landings were moderately- to well-drained. Initial gully erosion (SET 3) was the worst erosion encountered and this only occurred on one of the evaluated operations. Two of the landings (25%) were located in the protective strip. We did not find petroleum spills on any of the landing sites.

Table 1. Landing data for the eight properties.

Landing	Size (acres)	Slope(%)	SET	In stream protective strip	Seeded and mulched	Diversions	Oil
1	0.810	0-5	2	No	No	No	No
2	0.200	0-5	1	No	Yes	Yes	No
3	0.004	0-5	1	Yes	Yes	No	No
4	0.045	0-5	3	No	Yes	Yes	No
5	0.250	0-5	1	No	No	No	No
6	0.200	0-5	1	Yes	No	Yes	No
7	0.200	0-5	1	No	No	No	No
8	0.880	0-5	1	No	No	No	No

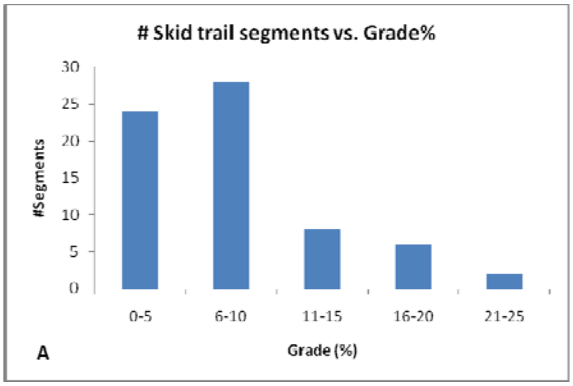
Skid Trails

To analyze skid trails, we assessed the same criteria as employed in the assessment of truck roads. We measured skid trail segments starting from the main landing. The first segment measured was 1.5 chains (i.e. 99 feet) in length and segments thereafter were 3 chains (i.e. 198 feet) in length.

Functional Drainage Structures

None of the observed skid trails were fully compliant with the AMP recommendations for the number of functional drainage structures (FDS). However, 17% of skid trail segments met FDS compliance standards. Compliance rapidly decreased with increased grade with 0%

compliance on skid trail segments of more than 11 percent grade (Figure 3b). At the most AMP compliant property, 60% of the skid trail segments had the minimum number of recommended FDS, while the least compliant had none. Roughly 76 percent of the skid trail segments were graded 10% or less, with the number of segments decreasing with trail steepness (Figure 3a). Most of the segments (76%) were at grades ranging from 6 to 10%. Despite this, fewer segments of 6-10% grade contained adequate functional drainage structures and compliance decreased on higher grade skid trails (Figure 3b).



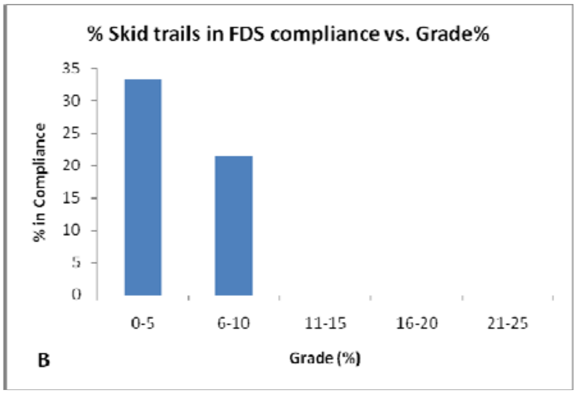


Figure 3a. Distribution of the number of skid trail segments by grade. **Figure 3b.** 33% of skid trails under 5 percent grade are in compliance with the AMPs for recommended number of FDS.

While there were some fluctuations, surface erosion had a moderate, positive correlation with grade. The lack of compliance over the 16-25% grade interval had a marked impact on the amount of surface erosion (Figure 4) with surface erosion on this interval being 12-24 inches deep. Although no segments in the 11-15% grade interval were compliant, surface erosion decreased considerably. This is in stark contrast to the 0-5% interval which had the greatest functional drainage structure compliance (33%, Figure 3b) but slightly higher surface erosion values. The increase in surface erosion over the steeper segments demonstrates the detriments of non-compliance but suggests erosion extent is highly variable and contextual.

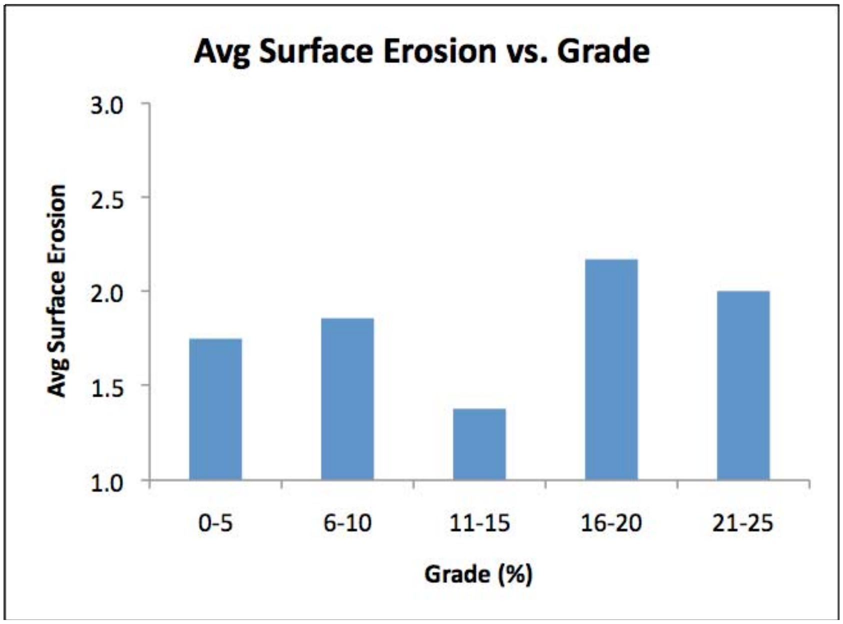


Figure 4. The SET values represent the averages of 68 skid trail segments among the displayed grades. 1=sheet, minute rills present, 2=rills up to 6 in. deep, 3=gullies 6-12 in. deep, 4=marked gully erosion 12-24 in. deep.

Protective Strip Width

The examined properties had good overall compliance with recommended protective strip widths. Most of the properties had skid trails with 75-100% compliance. One property had segment compliance between 51 and 75% (Figure 5). There were some instances in which properties would be hard pressed to achieve high compliance levels with recommendations for protective strip width due to mountainous topography. In such cases, it is crucial to meet the AMP standards for diverting sediment flow into nearby streams.

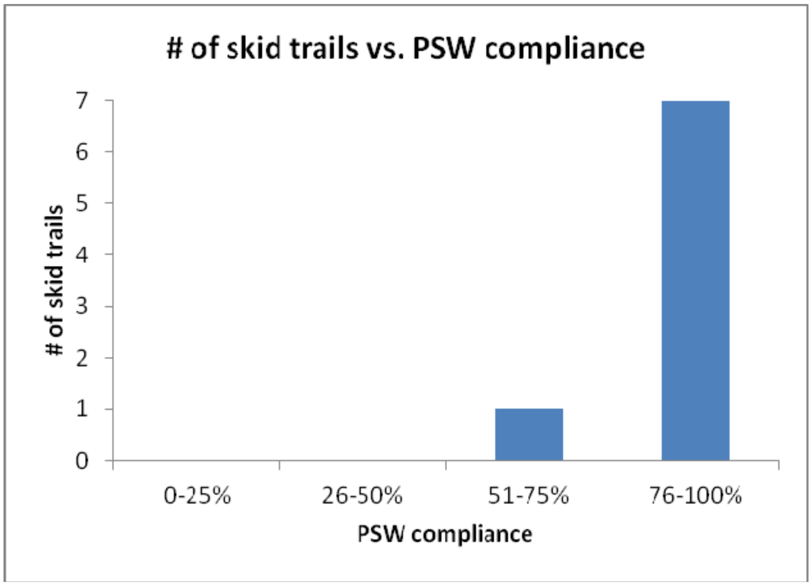


Figure 5. Most of the seven properties have skid trails with more than 75% of their segments in AMP compliance for PSW. Only one property had a skid trail with less than 75% of its segments in compliance.

Stream Crossings

We analyzed stream crossings with several criteria, including: road type (ROAD); stream type (STREAM); stream crossing type (CROSS); functional and minimum structure size (FSS, MSS); crossing angle (ANGLE: 'Yes' = 80-90°; 'No' = <80°); streambed and approach stability (STABLE); broad base dips (BBD) installed before the crossing; sedimentation evidence within one chain (SED: '1' = natural; '2' = thinly coated; '3' = plumes, thick deposits); slash and woody debris within one chain (DEBRIS: '1 = natural; '2' moderate; '3' = blocking stream flow); and evidence of oil deposition (OIL).

The five stream crossings on four properties all involved permanent streams (Table 2). Two of the crossings were permanent truck roads and three were skid roads. Three of the crossing structures were bridges with functional structure sizes ⩾10 ft^2. While two structures displayed evidence of minor sedimentation within one chain of the structure, most exhibited natural slash and woody debris within the same distance. However, one crossing did contain debris that blocked or altered the stream flow. Broad base dips (BBD) preceded only 40% of the stream crossings. Crossing number 3 lacked a BBD which may explain the thin coat of sediment observed in the streambed. The installation of a BBD, in addition to seeding and mulching, may decrease sedimentation at this site. Petroleum was observed on the ground at one landing.

Table 2. Stream crossing data for four properties.

Crossing	Road	Stream	Cross	FSS	MSS	SED	Debris	Angle	Stable	BBD	Oil
1	Perm. Truck	Permanent	Bridge	900	Un-known	2	1	Yes	Yes	Yes	No
2	Skid Road	Permanent	Bridge	22.5	28	1	1	Yes	Yes	Yes	No
3	Perm. Truck	Permanent	Bridge	13.96	544	2	1	Yes	Yes	No	No
4	Skid Road	Permanent	Metal Culvert	3.1	7.5	1	1	No	No	No	No
5	Skid Road	Permanent	Bridge	10	10	1	3	Yes	No	No	Yes

Stream and Surface Water

The criteria we used to analyze stream and surface water were: protective strip canopy condition (PSCC: ‘1’ = no apparent change; ‘2’ = light thinnings; ‘3’ = large openings created); dominant condition (COND: ‘1’ = natural; ‘2’ = moderate; ‘3’ = heavy sedimentation, bank cutting, stream relocated); number of buffer strip entries (BSE); number of skid trail or road crossings (XING); the number of tops/logging debris in streambed (DEB); and whether skidding practices occurred in the stream (SKID).

The six stream protective strips were of permanent streams. Only one of the protective strips displayed a large opening in the protective strip canopy (Table 3). The streams were all in a natural condition except one with moderate sedimentation as the greatest amount observed. Only one stream had logging debris in the streambed and no streams contained evidence of skidding. The greatest stream and surface water concern is a depleted canopy above the protective strip and moderate amounts of debris (but varying by location).

Table 3. Stream and surface water data for six properties.

Stream	Stream type	PSCC	COND	BSE #	XING #	DEB #	SKID
1	Permanent	Light thinning	Natural	1	1	0	No
2	Permanent	No change1	Natural	2	3	2	No
3	Permanent	Large opening	Moderate	0	1	0	No
4	Permanent	No change	Natural	0	0	0	No
5	Permanent	Light thinning	Natural	1	0	0	No
6	Permanent	No change	Natural	0	0	0	No

Overall AMP Compliance

The observed properties were fairly compliant with the AMPs. They were least compliant for truck roads and skid trail erosion control and moderately compliant for log landings, stream crossings, and surface water protective strips. While the properties generally did not comply fully with the AMP standards, achievement of increased compliance is well within reach. Not only will AMP compliance promote better water quality, it will enhance the local ecosystem. Based on this analysis, these forests may benefit from several plans of improvement:

1. The installation of more functional drainage structures, especially in moderate-high grade (6-10+%) skid trails, as surface erosion and grade have a strong positive correlation and skid trails are particularly non-compliant.

2. Functional drainage structures should also be installed in truck road segments (especially low-grade), and bolstered in steeper segments.

3. The continued careful monitoring of water bars, broad-based dips, and other functional drainage structures that prevent the erosion of sediment and its deposition in nearby streams.

4. The continued care in avoiding placement of truck roads, landings and skid trails in protective strips.

5. For truck roads, landings, and skid trails that are placed in protective strips, this is difficult and costly to fix. Instead, care must be taken to seed and mulch such landings and install hay bale checks, silt fences, and other water diversions in the truck roads and skid trails (criteria for which AMP compliance is low).

6. The continued care in preventing oil from contaminating log landings, for which our observations determined all properties were in full compliance.

Landowner Interviews

We interviewed eight private or commercial landowners within the Five-Town Forest, addressing personal and community connections to the land, current land use and management practices, challenges and opportunities, and goals for the future. We structured the interviews in an informal and casual manner as recommended by the Vermont Folklife Center (Munroe, 2008a; Munroe, 2008b). Every interview was an interactive conversation, and as such, none of us asked exactly the same questions. But we made a point of asking the following nine questions in some form:

- How did you come to this land and when?
- What changes have you noticed over the last 5, 10, 15, or 20 years?
- What aspects of your land do you find valuable and/or appreciate?
- In what ways do you feel that your forest plays an important role in your community and/or your household?
- Do you think people understand how this forest affects their water supply?
- How do you primarily use your land? What economic benefits do you gain from it and how central are those to your livelihood?
- Are you satisfied with your land practices and do you face any constraints preventing you from managing the land differently?
- What, if anything, would inspire you to fully comply with the AMPs?
- Where do you see yourself and this land in ten years? A hundred years?

Asking each landowner this set stock of questions returned more comparable results for a stronger analysis and understanding of each owner's relationship to the land. However, we did not set out to have a quantifiable survey. Rather, we wanted to characterize the nature of the relationships that the residents of the Five-Town Forest have with their forests as individuals and as a community.

Four consistent themes emerged from these interviews. The first was a deep connection between the landowners and their land. The second was financial constraint; most landowners felt that finances prevented them from enacting the land management practices they thought most necessary. The third theme was a widespread unfamiliarity with the AMPs. Finally, landowners generally did not see their forests as being part of a unified watershed. Though they recognized and valued the social interconnectedness of their forests, they did not acknowledge that their lands had parallel ecological interconnections.

Deep Connection Theme

The connection between the landowners and their forests was immediately apparent in every interview. Everyone we spoke with had a tremendous passion for their land and most saw themselves as stewards rather than mere owners. The Little Hogback Community Forest is an excellent example of a community of passionate stewards. Membership in the cooperative was first limited to low-income individuals, but has since expanded to include people living adjacent to the land and others who were attracted to the group's shared values. Specifically, the people involved all share a sense of stewardship for the land and value its continued health. One such member said that he "wants to be part of something done right."

One property near Bristol was purchased by its current owners in the late 1980s. Owning the land was so important to them that they resorted to "creative financing" in order to secure it, but they felt it was worth it. They raised their family there and one of their daughters now lives on the lot. She said that growing up in the forest has defined her life. She now lives there with her boyfriend and they have planted a 9,000 square foot garden, most of it berries and vegetables, and they hope to expand it by nearly 40% in coming years. Her father, too, is excited about the project. "He'll spend literally all day out there," his daughter said. "He loves that land."

Another landowner has spent most of his eighty years on the same plot of forest his family has owned since 1909. He still loves hunting on his land, though recently he's had to use his gun as a cane. The steep logging road that led from his house up to hillier terrain was washed out in 2006 and he hasn't been able to get up there since. He spoke nostalgically of the forest atop his hill, of sugaring in the spring, and of enjoying the forest's seasonal changes with his family.

On the commercial side of landownership, the feeling is no different. At A. Johnson Co., the interviewee gestured around the office. "It's messy," he said, "because everyone would rather be out in the woods." From the professional foresters to partial shareholders in their home forest and families with generations born and raised on their land, we saw a universal respect and care for the forest.

Financial Constraint Theme

The majority of landowners cited financial constraints as the primary impediment to bridging the gap between their current management plans and their desired management. They felt that the practices they wanted to enact were prohibitively expensive. The impediments they faced varied from property to property, as did the scale of these challenges. The private landowners stated that they had difficulty funding the necessary labor. "Land management" on these properties is predominantly work they do themselves in their spare time.

Given their passion for their forests, we can assume that the purpose of the practices these landowners want to put in is the overall betterment of their land. The implication here is that landowners perceive their current practices to be insufficient in some way. The gap between their perceived ideal management and their actual management is caused by associated costs.

The A. Johnson Co. is in a different position. They and other businesses are operating at a larger scale—regionally in most cases, but sometimes capturing interstate or even international business. As a smaller business in Vermont, it is difficult to compete with the massive international corporations which have far greater resources to harvest timber at cheaper prices and out-compete small local companies. Additionally, the lumber market is notoriously unreliable in the face of shifting energy markets and faltering economies. It is nearly impossible for companies to predict profits for the next year; so short-term operations are filled with uncertainty.

Timber industries throughout the country are feeling the strain. In many cases, companies subdivided their holdings and sold bonds on them to avoid liquidation. To support bond prices, companies were forced to manage forests for maximum income, which leads to intensive extraction followed by the sale of exhausted land.

As a corporation bound to a finite land area, A. Johnson Co. is necessarily motivated to harvest sustainably as failure to do so will ultimately result in bankruptcy. The challenge is to avoid bankruptcy without overharvesting. They are still in the black, due in no small part to their commitment to ecological forestry. “The Johnson family takes a great deal of pride in the way they handle their land,” said one employee.

AMP Unfamiliarity Theme

Despite their obvious investment in forest health, the vast majority of landowners were unfamiliar with the AMPs. When asked, most people were either unfamiliar with, or had only a vague idea of the guidelines. Despite an explicit desire to manage their land well, most landowners do not know the basic steps to maintain logging roads and skid trails or how many drainage structures to construct on a path of set grade.

Those individuals who recognized the AMPs were familiar with them through interactions with David Brynn of Vermont Family Forests (VFF). Although VFF does have some educational programs, the scope needs to be expanded in order to reach more landowners.

One such landowner has had several logging jobs on his property, each of them arranged by VFF. The landowner said, "[It] wasn't ever about making the maximum amount of money." He wanted to do it properly, "in a very organic way." He stipulated that the timber must be going towards a project that benefits the whole community, one that would have a lasting impact on future generations. He was familiar with the AMPs, but for him they were "something that the foresters dealt with."

An unfortunate corollary of this lack of awareness is that even with financial freedom, many landowners might not reach full compliance with the AMPs for the simple reason that they aren't familiar with them. One notable exception was the A. Johnson Co., which follows AMPs as completely as possible. "Everybody, for the most part, who is left in this business follows them to a certain degree," they said.

Lack of Awareness of Interconnectedness Theme

Although landowners displayed in-depth knowledge of their forests, they generally did not see them as being part of a comprehensive watershed. In general, they had very little awareness of the ecological interconnectedness of their landscape. One landowner expressed this quite well: "The streams and rivers in this area are enormously important, and funnel a huge amount of water off the mountains, but awareness of their important role and the need to very carefully manage them seems mixed. Water is an enormous presence and force in the landscape here, and yet I wonder how many people would see it that way."

One landowner said that most of the maintenance he did on his land was for "aesthetic purposes." He said he wanted to remove a pile of slash from a stream on his land but that was his only mention of water quality. This trend was common throughout the interviews: people want to manage their land well but they do not see water quality as part of the equation. No one acknowledged that their management decisions affected not only their land but everyone downstream as well.

Most landowners view their property as a social resource – one in which property boundaries are less important than the natural and interpersonal connections the land supports. One lot near Bristol has an extensive network of trails that run across property lines and boundaries, maintained by both the landowners and their neighbors. To their daughter, who grew up there, seeing neighbors walking through her woods is a normal sight. However their biological perception of the land is different; social interconnectedness is more visible than ecological interconnectivity. People think of the forest on a very small scale—their own property. They do not see the land as a watershed, as an interconnected patchwork of forests on which their land is but a small part. In the social sphere, very little importance is attached to property lines; in the biological sphere, they delineate the scope of their perceived landscape. This misconception of the biological and ecological landscape has very serious implications. One cannot practice good management of a system they do not fully understand.

Each landowner has a unique relationship with their land, each with different intentions, motivations, and challenges. However, four primary themes emerged: a deep connection with the land; perceived financial constraints; a lack of awareness of AMPs; and a lack or awareness of the ecological interconnectedness of the landscape. Most of private landowners saw value in the wildlife, aesthetics, firewood, and recreation within their forests. None of the landowners stated the value of water quality before being directly asked the question of whether water quality was important to them. In many cases, landowners felt as though their forest was not only for their own good, but that it was also benefiting other members of their community or supporting a local economy. Some landowners donated or sold timber, biomass, and maple sugar, while others, including A. Johnson Co., opened their land for community recreation.

The closing sentiments of every interview were a sense of hope for the future. The people of the Five-Town Forest aspire to manage their forests well. They want to ensure the continued existence of their woods. The forest has played a sometimes subtle, sometimes quite obvious role in shaping these individuals and their communities. People care deeply about their land, and this passion will be a driving factor in the future of the Five-Town Forest.

Five-Town Forest Community Cooperative

Over the course of our study we became aware of many somewhat disconnected efforts that could be used more effectively to conserve water quality in the Five-Town Forest while harvesting more forest biomass. However, it became apparent to us that there was a need for a new, integrated, community-based, vehicle or organism to increase buy-in and to act as a vehicle for change. There was also a demonstrated need for weaving together shared interests in the Five-Town Forest. More specifically, if water quality is to be conserved while harvesting more forest biomass, several concurrent goals needed to be achieved:

1. Address educational needs of the community;
2. Cultivate economic opportunities for landowners and loggers; and
3. Secure community support.

Landowners, loggers, forest product value-adders, customers, government, and non-governmental organizations need to see themselves as 'invested shareholders' in the effort. We decided that this called for the *Five-Town Forest Community Cooperative*.

Mission

To ensure the preservation of water quality while sustainably harvesting biomass in the Five-Town Forest by: enhancing educational outreach, increasing community connections with the forest and cultivating a sustainable economy of forest conservation and stewardship.

Values

The Five-Town-Forest Community Cooperative—its staff, members, landholders, and loggers, foresters, truckers, other value-adders, associated non-government organizations, customers, and other community members—shares a deep and lasting commitment to forest ecosystem health, the well-being of the community, multiple opportunities for local value-adding, and life-long learning.

Forest Health

The FTF Community Co-op is dedicated to preserving water quality by maintaining a healthy forest ecosystem. It has long been known that there is a close relationship between the quality of our water resources and land health. The state of Vermont is 78 percent forested. How we decide to utilize the forest is a critical factor in determining the quality and quantity of groundwater and surface water (VT ANR, 1999). If our relationship with the forest is unsustainable, especially in high-elevation watersheds, we can change a stream's hydrology with the result of higher flood flows, movement of stream channels, and excessive erosion. In order to prevent the deterioration of our watershed here in the Five-Town-Forest, all products endorsed by the Co-op will come from monitored land that is in full compliance—or at least substantial and ever-increasing compliance—with the *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont.*

Education

Aldo Leopold once said that "Conservation means harmony between men and land. When land does well for its owner, and the owner does well by his land; when both end up better by reason of their partnership, we have conservation. When one or the other grows poorer, we do not" (Leopold, 1949). The FTF Community Co-op believes in this environmental ethic and wants to teach community members how to make it possible through educational initiatives. Contributing to a more widespread understanding of the intrinsic relationship between water quality and forest health will ensure a secure future for the FTF Community Co-op and the forests that it manages.

Economics

Our mission is to protect water quality through ecologically sustainable logging practices that are at least in compliance with Vermont’s AMPs. However, we understand that there is more to sustainability. We understand the economic constraints felt by landowners and seek to provide them with resources to support them in improving their stewardship of the land. We will not compromise their land rights. Rather we seek to be first and foremost a resource to help them and to provide assurance that the land they love is being well managed.

Community

We will build on the strong ties between fellow members of the Five-Town Forest and their land in order to create a strong community commitment to forest stewardship and water quality. We recognize that we have a difficult task ahead of us, but also that our strength lies in teamwork and a commitment to our mission and each other.

Actionable Memorandum

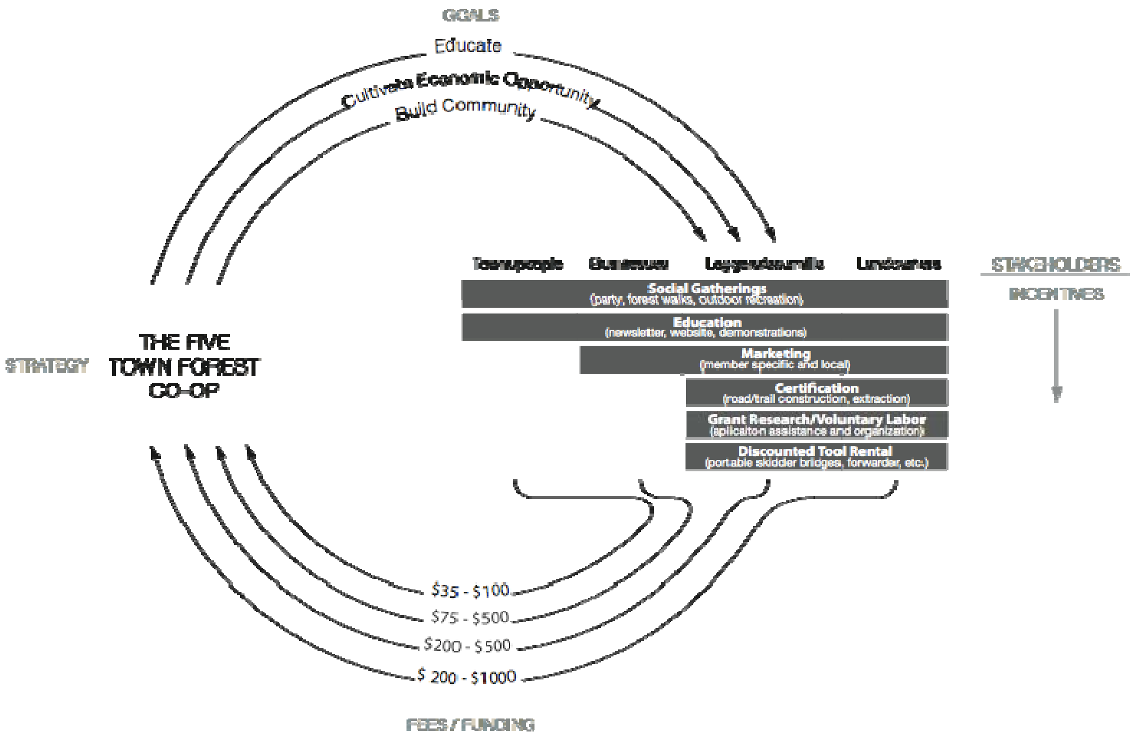

GOALS
Educate
Cultivate Economic Opportunity
Build Community
STRATEGY
THE FIVE TOWN FOREST CO-OP
Townspeople
Businesses
Loggers/sawmills
Landowners
STAKEHOLDERS
INCENTIVES
Social Gatherings (party, forest walks, outdoor recreation)
Education (newsletter, website, demonstrations)
Marketing (member specific and local)
Certification (road/trail construction, extraction)
Grant Research/Voluntary Labor (aplicaiton assistance and organization)
Discounted Tool Rental (portable skidder bridges, forwarder, etc.)
$35 - $100
$75 - $500
$200 - $500
$ 200 - $1000
FEES / FUNDING

Figure 6. The Five-Town Forest Community Co-op diagram illustrating the basic framework supporting the Co-op and how it will be self sustaining.

Goal 1: Educate the community, landowners, and loggers on the health of the watershed and its impact on individuals and businesses in the Five-Town Forest.

> Plan: Distribute pamphlets at public service centers, create a biannual newsletter, provide mailings to residents of the five towns, develop an informative website, host demonstrations, provide certification for loggers, and produce an annual certification update.
>
> Example: AMP decoded (Appendix 2)

A critical part of the Co-op's mission is educating the public about the importance of preserving water quality. The first step for maintaining water quality on working woodlots is full compliance with the *Acceptable Management Practices for Maintaining Water Quality on Logging Jobs in Vermont*, or AMPs. It is important to note that the AMPs were developed by an incomplete group of stakeholders and are outdated. However, for the purpose of this project, we base our work off the existing AMPs, assuming that achieving compliance will be ensure baseline water quality conservation in the Five-Town Forest.

Most AMP practices must be implemented prior to the logging job, so it is important that landowners as well as foresters and other contractors are familiar with them. Copies of the AMP booklet are freely available at Vermont Family Forests in Bristol, as well as online at www.vtfpr.org/htm/gen_publications.cfm. The booklet, however, is very dense reading. In Appendix 2, we provide a companion document that provides a simple overview of each practice. Each practice is accompanied by a brief ecological explanation of why the practice is important.

Goal 2: Reduce economic burden of complying with suggested practices and maintaining superior water quality.

Plan: Provide a database of grants available to all members organized in an accessible way. Provide guidance in the grant application process. Find and organize voluntary labor to improve AMP implementation and to monitor compliance.

Example: Funding (Appendices 3, 4a, 4b)

The economic realities of timber and biomass harvest necessitate that the Five-Town Forest Cooperative entity is subsidized through federal or state funding. Furthermore, the FTF

Cooperative will support its members by providing them with access to a database of funding options for privately owned and managed land. Funding is not limited to silviculture-related grants. The mission and values of the Cooperative deal closely with water quality and community and renewable energy (i.e. biomass), so the Co-op aims to present funding opportunities in these areas as well. We foresee that local landowners will utilize this resource and apply for grants to improve the management of their forests.

The funding options are organized into several appendices based on the extent and the source of the funding. Appendix 3 lists the Cooperative-wide options provided by a national source. Appendix 4a lists grants suited for individual landowners provided by the national government. Finally, Appendix 4b provides state-level funding options for individual landowners.

At the national level, much of the available funding is provided through the United States Department of Agriculture. For example, the USDA's Community Wood Energy Program is designed to support community wood energy planning. The program encourages more efficient wood use from forest management activities, yielding valuable fuel sources and offsetting fossil fuel demand. These grants can provide as much a $50,000 for community wood energy planning.

At the state level, the Watershed Forestry Program under Vermont's Clean and Clear Water Plan focuses efforts on education, outreach, and technical assistance to forest landowners, loggers, forestry professionals and the general public. The state has appropriated more than $42 million for Clean and Clear over the first five years, which was matched by an additional $42 million from the federal government (VT ANR, 2009). These funds can be accessed by FTF

Community Co-op members through a variety of Department of Environmental Conservation (DEC) Grants listed in Appendix 4b.

Goal 3: Build a community of stakeholders who benefit from the watershed and care about its future.

> Plan: Host "walk in the woods days" to showcase sustainable forestry practices and to allow community members to develop a relationship with the forests. Host annual celebrations that bring community members together in support of their watershed. Ideas include: a beer festival with beer brewed from the waters of the FTF watershed (Otter Creek), hosting public walks of FTF properties, and giving community members the opportunity to recreate and to hunt on select lands.

To further the effort to achieve these goals the FTF Community Co-op will provide consultation to landowners on how they can achieve better watershed quality. It will provide consultation on timber extraction, skidder road retrofitting, and FSC Certification.

Additionally, there are two long term aspects of the Co-op that can be enacted once it is established:

Goal 4: Facilitate improved watershed quality on federal lands

> Plan: This is a matter of finding the right State or Federal agency to procure control of the maintenance and monitoring of federal lands in the Five-Town Forest so that the watershed quality of these public lands can be improved and maintained.

Goal 5: Sell watershed quality-improving products and facilitate the sale of biomass. It will sell biodegradable bar and chain oil, facilitate timber sales between landowners and other Five-Town Community Co-op members and establish a wood co-op. The wood co-op will be under the umbrella of the 501c3 and be managed by a volunteer board of directors

> Plan: The wood co-op will collect a 5% fee on sales of all FTF/FSC certified products in retail establishments. A portion of these funds will be used to market locally grown, FTF Wood. The co-op would market and encourage sales of FSC "like"/FTF wood on behalf of landowners and business members although it would not be selling its own products. In order to generate a small annual marketing budget, we recommend two fees-for-service that would be earmarked specifically and exclusively to marketing our wood. This co-op would also collect a landowner harvest fee. At the time of harvest, for volumes over 25 thousand board feet (MBF) of commercial timber, not cordwood or pulpwood, we recommend charging members a small fee of $2/MBF. This means that a 25,000 board foot harvest would be $50. This fee gives the Co-op staff incentive to encourage members to harvest according to their management plans, and generates a small amount of marketing money with little effect on member's bottom line. In addition to the 5% charged on the value of FSC "like"/FTF sales, we recommend a 2% fee (total 7%), which would be specifically designated for educating the community about their water shed. Following these recommendations, we anticipate raising approximately $4,000 annually to put toward marketing and fostering sales of FSC "like"/FTF wood. The Co-op would report to members and landowners annually on the total sum of these fees, and on how the money was spent in marketing efforts.

Logistics

Annual Membership Fees
(as a 501c3 status non-profit all membership fees will be tax deductible)

Community Members (Non-landowners)	$35-$100
Businesses	$75-$1000
Landowners	$100-$1000 (for economic services)
Loggers	$200 (for certification)

Note: Any "Landowner" who does not wish to receive economic services can simply support the initiative as a "Community Member"

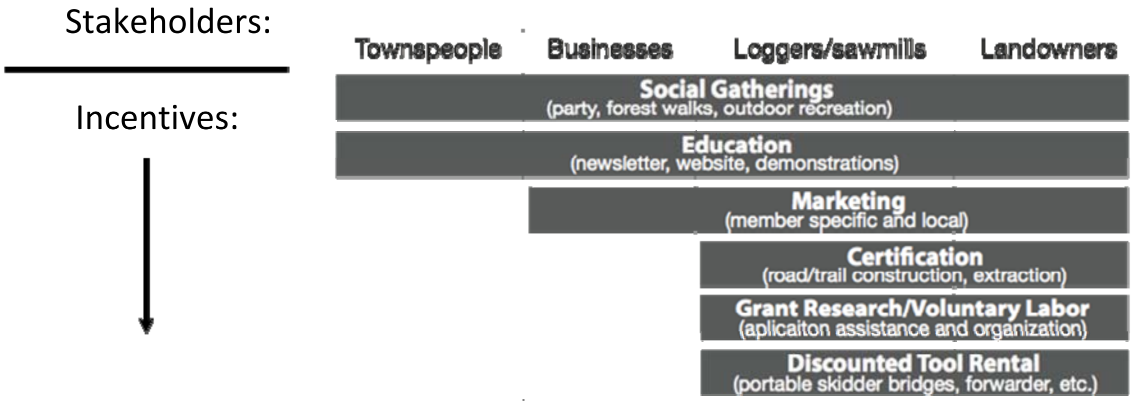
Contracts

Landowners commit to fully complying with the AMPs to the best of their ability and only using FTF certified loggers to extract biomass (of any kind) from their land.

Loggers commit to fully complying with the AMPs to the best of their ability and to attending one educational event a year to renew membership (an update of the newest practices or walking of another person's land, identifying compliance).

Incentives

All of the stakeholders, including land owners, loggers, community members, and local businesses, play a vital role in the Co-op in order to protect water quality, and each member will in turn benefit from the Co-op, beyond helping protect water quality.


Stakeholders:
Incentives:
Townspeople
Businesses
Loggers/sawmills
Landowners
Social Gatherings
(party, forest walks, outdoor recreation)
Education
(newsletter, website, demonstrations)
Marketing
(member specific and local)
Certification
(road/trail construction, extraction)
Grant Research/Voluntary Labor
(aplicaiton assistance and organization)
Discounted Tool Rental
(portable skidder bridges, forwarder, etc.)

Landowners

Landowners are the most integral component of the Co-op, considering they own the rights to their land and therefore decide how to manage it. In order to encourage the best management practices, the Co-op will provide landowners with the resources to adequately protect water quality. Based on the classes' interviews with landowners in the Five-Town Forest, economic constraints present one of the greatest challenges that limit compliance with AMPs in the Five- Town Forest. The Co-op will provide landowners with information on and assistance for available grants in order to provide funding to enable compliance with the AMPs. In addition, assuming there is willingness from some cooperative members and from programs such as Boy Scouts and Vermont Youth Corps to volunteer, landowners will have access to voluntary labor. Ideally, with the financial assistance from grants and with the access to some voluntarily labor, compliance with the AMPs will become more affordable and realistic.

Compliance will lead to more sustainable forestry practices that will allow for the production of biomass that has the potential to benefit from value-adding. The biomass extracted from woods in the Five-Town Forest that belong to the Co-op can be branded in a way that will reveal its sustainable sourcing, which should lend itself to higher values. Value adding will lead to greater returns, to further help support the costs of compliance and encourage sustainable forestry practices in the Five-Town Forest.

Loggers/ Sawmills

The majority of landowners are not directly responsible for the extraction that takes place on their land, aside from very small scale firewood extraction, which is why it is important to include loggers in the Co-op. Loggers will be provided with resources and incentives to learn about AMPs and how to comply with them. Loggers will be given access to discounted trainings to make it more affordable for loggers to learn how to comply with AMPs. In many instances, loggers need equipment, such as log forwarders or forwarding trailers, in order to optimally protect water quality. Loggers will be provided with discounts for equipment to make it more economically feasible to use the technology that will lend itself better to the mission of the Co-op. Loggers will also have the opportunity to gain a certification identifying them as loggers who comply with the AMPs so that they can be referred to landowners within the Co-op for hire.

Townspeople

Community members who choose to support the mission of the Co-op commit to learning more about water quality issues and receive the opportunity to develop relationships with the forests and larger community. Community members will receive a token of their support, possibly a sticker, to show that they play a role in the Co-op's mission to protect water quality in the Five-Town Forest. Members can also subscribe to a biannual newsletter to receive information on water quality and forestry in the Five-Town Forest. Members will gain access to certain land that landowners are willing to open up for non-motorized recreational use. Allowing members to use the land will help create a connection between Co-op members and the land. There will be an annual celebration for all of the members to help cultivate a community centered on water quality.

Businesses

Local business will benefit similarly to community members, in that they will receive a token of their support, a biannual newsletter, an invitation to the annual celebration, and the opportunity to be part of a community that values water quality. Local businesses who value social responsibility will be provided with the opportunity to support local water quality. In addition, local businesses have the opportunity to donate "discount days" at their business for Co-op members. "Discount days" will benefit Co-op members , and potentially create a new consumer base for some local businesses by attracting Co-op members, therefore benefiting the business as well.

Case Studies

The structure and strategies of the Five-Town Forest Community Co-op are representative of successful aspects of organizations across the country, such as the Living Forest Cooperative, The Mount Grace Land Conservation Trust, and The Massachusetts Woodland Co-op. These entities that serve a similar purpose to our proposed FTF Co-op provide insight into its potential success.

The Living Forest Cooperative in Ashland, Wisconsin created a for-profit business in response to the economic hardships of small landowners, similar to those in the Five-Town Forest. The LFC aims to “restore the forest to ecological stability while producing high quality value-added wood products, and strengthening communities with a sustainable forest products business.” The LFC recognized the need for sustainably managed forests in Ashland because recent practices favored short-term economic gain rather than long term forest health and profitability, also similar to the situation in the Five-Town Forest. Unlike the FTF Co-op, the LFC is limited to landowners. However, they receive management assistance and third party certification to produce value-added products, both of which are essential components to the FTF Co-op. Part of our mission is to develop a community based around the watershed in the Five-Town Forest, which is why we are proposing an entity inclusive to a boarder base than just landowners. Although the LFC fails to include community members in its mission, they undertake initiatives to reach out to the community through “field days” and newsletters. The LFC sponsors “field days” that take place on a cooperative member’s land to show both the public and co-op members examples of sustainable forestry, which is similar to our proposed “walk in the woods days”. Finally newsletters are distributed to members and made accessible to the public to raise awareness in the community (Living Forest Cooperative, 2010).

Although it is structured as a for-profit business, the LFC holds similar values as our proposed FTF Co-op, and can serve as an example in the future when we focus more on the idea of a value-added wood Co-op. The LFC offers a variety of forestry services, such as timber sale design and administration, tree planting, and ecosystem restoration, which the FTF can model from in the future.

The Mount Grace Land Conservation Trust (MGLCT) and the Massachusetts Woodland Co-op (MWC) are two examples of community-supported organizations focused on improving forest environments while harvesting biomass. The MGLCT serves 23 towns in Massachusetts, just south of the Vermont and New Hampshire borders. Its public interest categories include watershed quality, habitat protection, timber management, recreation (including hunting and fishing), and other forms of public access. Many of these objectives are shared with the FTF Co-op, however the mechanism that the MGLCT uses to facilitate this improved relationship between inhabitants and the forest differs from the mechanism of the FTF Co-op. The MGLCT finds the right State or Federal Agency to buy the conservation restriction (CR) from the private property owner. They act as funding intermediaries to get the property off the market and out of the hands of residential and commercial developers, successfully conserving 22,000 acres since 1986. The FTF Co-op is primarily focused on improving the watershed quality of private landowners without a change in ownership. However, this model is interesting in regards to the Federal lands within the Five-Town Forest. Through the right Federal or State funded agency to procure control of the maintenance and monitoring of federal lands in the Five-Town Forest, the watershed quality of these public lands can be improved and maintained (The Mont Grace Conservation Land Trust, 2010).

Like the FTF Co-op, the Massachusetts Woodland Co-op works with privately owned smaller forests. It provides an aggregate of forest resources to its membership. These resources include the knowledge of sustainable harvesting and milling, cutting plans, and an inventory of property. It offers aggregated sales like VFF, cutting from multiple landowner plots so that it can approach larger buyers and gain pricing power. They have also recently begun an initiative to solicit membership of non-forest owners who support the protection of local working landscapes and the amenities they provide. This model provides a local example that is now taking steps to implement strategies previously proposed as an essential part of the FTF Co-op (Massachusetts Woodlands Cooperative, 2010).

Conclusion

The Five-Town Forest has the potential for vibrant ecosystem health and ambitious biomass harvesting. A community management model will inform forest stewardship, offer economic opportunity, and encourage stakeholders to become both emotionally and interpersonally invested in the land that surrounds us.

We all share responsibility for clean, clear, highly oxygenated water in the Five-Town Forest—as residents of the towns, members of the Middlebury College community heated by biomass, and as world citizens interested in bringing our fuel consumption down to the local scale. The Co-op is merely the first step in a comprehensive community system that will support recreational use, considerate biomass harvest, and valuation of forest products from the area. By focusing on community management—where the men and women who own, use, and care for their forest plots will guide decisions—the Co-op can mold itself organically to the demands of the land and its people.

Aldo Leopold (1949) encouraged us to “examine each question in terms of what is ethically and aesthetically right, as well as what is economically expedient.” Our proposed model leaves room for continued ethical and aesthetic management of our resources, which will foster economic development for all.

We hope to see healthy trout populations, to prevent sedimentation and property loss from erosion, and to keep petroleum and nutrient pollution out of the headwaters of the Little Otter and Lewis Creeks and the Huntington and New Haven Rivers. We envision partnership with Vermont Family Forests, the River Stewards program, with hunters and fishermen of the region, and continued integration with the Conservation Commissions of the Five Towns.

This framework also has potential to find grants directed toward the Green Mountain National Forest, or to expand to offer small-scale firewood harvests to its members. The Co-op's monitoring and valuation systems offer loggers, landowners and mills the economic independence to pursue more ecological forestry. And these are only a few of the opportunities available to the Five-Town Forest Community Co-op. The community scaffold encourages all members of the Co-op to develop new projects, innovative energy programs, and watershed protection initiatives centered on the regenerative capacity of our home woodsheds.

Acknowledgments

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Finally, this project wouldn't have been possible without the passion and dedication of David Brynn. His leadership and endless belief in the Healthy Watersheds ~ Home Woodsheds project motivated us all. David's familiarity with the logging process, the communities of the Five-Town Forest, and his faith in its people to create change were the heart of this work. He is an inspiration to us all, and makes wicked flatbread pizza to boot.

Appendices

Appendix 1: Nine Interview Questions

Background/ Context

1. How did you come to this land? When?
2. What changes have you noticed over the last 5/10/15/20 years?

Personal Connections

3. What aspects of your land do you find valuable? What do you appreciate about your land?

Community Connections

4. In what ways do you feel that your forest plays an important role in your community? Your household?
5. Do you think people understand how this forest affects their water supply?

Current Use

6. How do you primarily use your land? And what economic benefits do you gain from it? How central are those to your livelihood?

Management Challenges / Opportunities

7. Are you satisfied with your land practices? Are there constraints preventing you from managing the land differently?
8. What, if anything, would inspire you to fully comply with the AMPs?

What the Future Holds

9. Where do you see yourself / this land in ten years? A hundred years?

Appendix 2: AMPs Decoded

Introduction

In the interest of simplicity, we have not gone into depth explaining the specifics of each practice. In almost every case, the proper implementation of these practices will require the AMP booklet. To make the transition between this document and the booklet as simple as possible, we reference specific tables in the booklet. Further, the technical definitions of many practices have been omitted. For example, we discuss broad-based dips but do not define them. The exact specifications of a broad-based dip can be found in the AMP booklet.

Legal Basics

You are not required to follow the AMPs. However, if there is any change in water quality near your property, and state inspectors find that you are not in compliance with the AMPs, you are liable for steep legal consequences.

Acceptable Management Practices

Access Roads

1. Steep pitches (greater than 10%) on permanent truck roads shall not exceed 300 feet in length.

Erosion will be nearly impossible to prevent on a road this steep. Water will move too fast to be effectively slowed, and it will create steep gullies in the road. The most immediate effect will be the damage to the road, making it harder and more dangerous to use. The second effect will be the massive pulse of sediment hitting whatever stream the water flows into.

2. Road surfaces must be adequately drained. Measures include broad based dips, pole culverts, or metal culverts.

These practices are mandated for the same reason as # 1, to prevent direct erosion of the road and thus sedimentation of local water. Even roads that are on very gentle inclines will still be an avenue for water damage. Because an access road is fundamentally different from the forest floor, water will flow much faster over the former. The consequence for this transformation is erosion, unless the proper measures are taken.

3. Water entering the roadway must be moved under or away before it gathers enough speed and volume to erode ditches.

This pertains to the size of culverts used to direct streams intersected by roads or skid trails. If a road is simply routed over a stream, the repeated passage of vehicles will have severe impacts. Frequent use can sever the upstream ecosystem from the rest of the watershed, isolating the populations of fish, macroinvertebrates, and other organisms. The area immediately downstream of the crossing will be flooded with sediments every time it is crossed, causing serious disruptions.

Further, the culvert must be big enough to accommodate the stream at flood levels, not just the usual flow.

4. Ditches must not feed water directly into streams or other surface water.

Ditches constructed parallel to the road are a good way to help prevent direct erosion of the road surface, but they will have serious consequences on water quality if they send the water directly into streams. Water coming from these ditches will be very turbid, so it must be dispersed into a stable area of the forest, allowing the sediment to settle out.

Skid Trails

5. Skid trails shall not go straight up a slope. Instead they should go at a gradual angle.

This is directed for the same reason as practice # 1. Compliance with this practice requires foresight, as a skidder going up a slope at a gradual angle is much safer if the road has already been constructed.

6. Straight stretches of skid trail must be adequately drained using outsloping turn-ups, broad based dips, or pole culverts.

This is directed for the same reason as practice # 2, but the methods of water control are adapted for skid trails.

7. Silt fencing, hay bales, or other water diversions must be used to prevent runoff from entering streams.

This is the equivalent of practice # 4, but for skid trails. The difference, in this case, is that water may be directed towards streams as long as there are sufficient barriers between the runoff and the stream. In the case of # 4, runoff cannot be directed towards streams at all.

8. Streams and all bodies of water shall be kept free of slash and other logging debris.

This is similar to practice # 3, although failure to comply can have much more serious consequences. Both practices are aimed at keeping streams and other bodies of water free from any material that would be there only as a result of human activity. Most practices are directed primarily at sedimentation, as this is the primary obstacle to high water quality. However, slash and other debris can also have serious impacts, and the consequences are felt at a much more local scale. They are direct impediments to stream flow and can block the movement of stream animals from one section to another.

9. Truck road crossings of all permanent streams shall be over a bridge or culvert. Fords are permissible only by skid trails where the streambed is stable and the approach is gradual. Brushing-in is permissible during frozen winter conditions, but all brush must be removed before spring runoff.

When streams are not crossed by a bridge or culvert, it is very important that the impacts be minimized. When fording is the chosen method, see # 3. When brushing is chosen, make sure that the crossing is restored as described in # 8.

10. All logging activities, except for necessary and proper construction of stream crossings, shall be kept out of stream channels.

For a detailed explanation, see # 3. Any activities that do occur in stream channels should be kept to a minimum, both in terms of the duration of the project and the impact to the stream.

11. Turn-ups or broad-based dips shall be used before a truck road or skid trail crosses the stream.

Similar # 1 and # 4, this practice is designed to keep water that is flowing over the surface of a road from going directly into a stream, carrying with it a large load of sediment.

12. Exposed soil within 25 feet of streams must be seeded and mulched. (See Table 3 in the AMP booklet for specifics).

It only takes one hard rain to turn a plot of exposed soil into a muddy torrent. Yet such plots are an unavoidable part of logging. Once the operation is completed, seeding and mulching the exposed plot will help keep the soil in place. This will benefit your land, as the rich topsoil will be available to your trees, and it will benefit the streams, which will remain sediment free.

Another important consideration when seeding exposed soil is the fact that areas that have been reduced to exposed soil are highly vulnerable to weeds. Many plant species that are not native to forest environments will quickly capitalize on exposed areas, growing very rapidly and forcing out other more desirable plants. Once weeds gain a foothold in your forest, they have the potential to disrupt the natural plant cycles there. Weeds will shade out wildflowers and even desirable saplings. It is much easier to prevent invasive plant species from getting established than it is to get them out, so make sure all exposed soil is dealt with quickly and properly.

13. Stream crossings must be made at right angles.

This is simply to minimize the size of area impacted. A diagonal crossing will affect much more of the stream and the riparian habitat than a direct right angle crossing will.

Protective Strips

14. Except for necessary crossing construction, a protective strip must be left along streams and other bodies of water. (See Table 4 in the AMP booklet for specifics).

Although only one of the twenty four AMPs deals directly with protective strips, they are extremely important. Riparian habitat, which is defined as the forested area on either side of a stream or river, is disproportionately important for the health of both forest and stream ecosystems. It is critical habitat for a wide variety of species and also serves as a movement corridor, allowing animals to travel from one area to another.

The riparian zone is also of critical importance for the health of your streams. Trees shading the stream keep the water cool, allowing species like Brook Trout to thrive. The plants along the edge of a stream or pool also serve as a filter. They naturally remove sediments and more serious pollutants like heavy metals from surface water before it hits a stream. At the simplest level, stream and pool environments existed for thousands of years surrounded by forest. Removing trees or otherwise altering the forest in the protective strips will alter the natural cycles of these environments.

Log Landings

15. Log landings shall be located on level or gently sloping stable ground.

For the same reason that steep roads or skid trails should be avoided, so too should steep log landings. The steeper the slope the more severe the erosion.

16. Landings cannot be within the protective strip.

Log landings are one of the highest impact areas of any logging operation, and thus it is extremely important for them to be located outside the protective strip. As discussed in #14, the riparian habitat protected by these strips is very ecologically important.

17. Silt fencing, hay bales, or water diversions must be used to prevent sediment from entering streams and other surface waters.

Given their size and the lack of ground cover, log landings are especially prone to serious erosion during severe storm events. These pulses of sediment can have serious effects on stream systems, and can even wipe out small vernal pools

Post Logging Practices

Post-Logging Truck Roads

18. Water bars on temporary roads must be properly installed.

Water bars are described in detail in Figure 12 of the AMP booklet. They are very similar to broad-based dips, and serve the same purpose.

Post-Logging Skid Trails

19. Ruts must be filled and smoothed if they offer any potential for gullying.

This is pretty simple. If ruts or gullies aren’t filled, you’ll end up with a big gash through your forest. Valuable topsoil is being washed away every time heavy rains carve those gullies deeper.

20. Water bars shall be installed.

Water bars serve two purposes. First, they are another erosion prevention measure. As outlined in Table 1 of the AMP booklet, they are much more frequent than broad-based dips. The second purpose is to limit access to trails. The use of logging roads and skid trails by ATVs is a major source of erosion, and frequent water bars will help deter people from using them. Simply placing a log or boulders across the entrance to roads and trail will be even more effective.

Post-Logging Surface Water and Stream Crossings

21. All non-permanent structures must be removed from streams. The channel must be restored.

Restoring the channel means that any alterations to the shape of the stream banks must be undone. There should be no evidence of human activity at the site.

22. All stream approaches must be stabilized, seeded, and mulched. (See Table 3 of the AMP booklet)

This is mandated for the same reason as #12. An important caveat: if it has been more than a year since the logging operation, do not seed or mulch. At that point, native species will likely be establishing themselves, and seeding and mulching could potentially wipe them out. This is not an excuse to simply wait a year and do nothing, the initial seeding and mulching is a critical measure to prevent serious erosion and maintain the integrity of the stream bank.

Post-Logging Landings

23. Landings shall be graded and water diversions installed.

Grading will even out any ruts or small gullies, preventing them from becoming a more serious problem. Water diversions will mitigate the effects of any erosion that does occur.

24. Exposed soil within the protective strip must be stabilized by seeding and mulching. (See Table 3 of the AMP booklet).

This is mandated for the same reasons as #12 and #22. Ideally, there will be no exposed soil in the protective strip in the first place, as it is a very sensitive area (discussed in #14).

Appendix 3: National Level: Cooperative-wide Funding

1. USDA: Community Wood Energy Program

http://attra.ncat.org/guide/a_m/cwep.html

Supporting community wood energy planning

Program Basics

The Community Wood Energy Program creates a new program to provide State, Tribal, and local governments support in developing community wood energy plans. Competitive grants are also available to acquire community wood energy systems and/or technical assistance for public facilities that use woody biomass as the primary fuel.

The program can provide support for conducting a woody biomass resource assessment and designing a monitoring plan. Assistance includes expanding an understanding of the technology available to achieve the best thermal efficiency to convert wood fuel for heating and cooling of buildings. This assistance can also include combined heat and power systems. The program affords an opportunity to better use wood from forest management activities, wood collected from municipalities (thus saving landfill space), and woody material from diseased and storm-damaged trees and construction sites. These are ongoing activities that can yield valuable sources of fuel to help offset the demand for fossil fuels.

Application and Financial Information

Grants will support systems that are smaller then 5 million Btu per hour for heating and/or 2 megawatts for electric power production as directed by statute. At least a 50 percent match is required from non-federal funds for grants. Technical assistance will be based on previous work and commitment to future work demonstrated by the applicant. The program is authorized $5 million annually when funded. Grant awards are limited to $50,000 by statute.

Eligibility, Uses, and Restrictions

The Community Wood Energy Program will provide competitive grants and/or direct technical assistance to encourage the development of community wood energy plans and/or acquire or upgrade community wood energy systems.

Assistance will be directed to State, Tribal, and local governments. To ensure sustainability of wood energy systems within the capacity of the landscape, a community wood energy plan will be required before program dollars can be used to acquire equipment.

Contact Information

US Forest Service
State and Private Forestry
1400 Independence Ave., SW

Washington, D.C. 20250-0003
Phone: (202)205-1657

2. USDA and U.S. Endowment for Forestry and Communities:

> "Our goal is to develop and promote markets for low-value wood, further domestic energy production and grow jobs in rural America while retaining healthy, working forests."

Carlton Owen, President & CEO of the U.S. Endowment for Forestry and Communities (the Endowment) announced on September 27, 2010 awards of more than $1.4 million in Woody Biomass Joint Venture Funds to support six projects designed to advance sustainable uses of woody biomass. The projects were the first anticipated under what the partners hope will be a multi-year initiative announced in June of 2010 by the USDA Forest Service and the Endowment.

Projects funded under the endowment:

- **Agri-Tech Producers**, LLC of Columbia, South Carolina, for the purposes of developing a "*demonstration torrefaction unit and to provide torrefied materials to various users for testing in their boilers*."
- **Environmental Defense Fund** of Raleigh, North Carolina in support of "*developing economically viable models of wood biomass procurement to conserve forest land, enhance ownership profitability and produce sustainably-grown biomass.*"
- **Greenwood Clean Energy** of Bellevue, Washington, to "*confirm market potential of an indoor EPA Phase 2 biomass gasification central heating appliance*."
- **HM3 Energy** of Gresham, Oregon, to "*build and operate a torrefaction pilot facility to supply woody-biomass-based energy to offset use of coal in electricity production*."
- **North Carolina State University** to support research in "*balancing in-woods drying tactics with delivered biomass payment practices*."
- **Phoenix Energy**, LLC of San Francisco, California, to "*develop a gasification process and equipment testing facility to produce green energy and biochar from woody biomass*."

The Forest Service and the Endowment each committed $2 million in the initial phase of the partnership. Funded projects will provide at least a 50% local match extending the impact of the initiative to more than $6 million. Projects funded were chosen from more than 70 candidates that the Endowment received in response to a request for proposals earlier in the year.

3. Conservation Innovation Grants

http://www.nrcs.usda.gov/technical/cig/

Conservation Innovation Grants (CIG) is a voluntary program intended to stimulate the development and adoption of innovative conservation approaches and technologies while leveraging Federal investment in environmental enhancement and protection, in conjunction with agricultural production. Under CIG, Environmental Quality Incentives Program funds are used to award competitive grants to non-Federal governmental or non-governmental organizations, Tribes, or individuals.

CIG enables NRCS to work with other public and private entities to accelerate technology transfer and adoption of promising technologies and approaches to address some of the Nation's most pressing natural resource concerns. CIG will benefit agricultural producers by providing more options for environmental enhancement and compliance with Federal, State, and local regulations. NRCS administers CIG.

Appendix 4a: National-Level: Funding for individual landowners

1. USDA: Biomass Crop Assistance Program (BCAP)

http://attra.ncat.org/guide/a_m/bcap.html

Providing financial assistance to producers or entities that deliver eligible biomass material to designated biomass conversion facilities

Program Basics

Authorized under Section 9011 of the 2008 Farm Bill, the Biomass Crop Assistance Program (BCAP) is designed to:

1. support the establishment and production of eligible crops for conversion to bioenergy in selected BCAP project areas; and
2. assist agricultural and forest land owners and operators with collection, harvest, storage, and transportation of eligible material for use in a biomass conversion facility.

Project Examples

The Farm Service Agency (FSA) is currently working to develop and implement the Biomass Crop Assistance Program. FSA is preparing an environmental impact study. After this impact study is drafted, FSA plans to publish more specific program provisions as regulations for BCAP in the Federal Register. Although exact dates are not available for this rulemaking, FSA hopes to implement BCAP in time for the 2010 crop year.

Application and Financial Information

BCAP is a Commodity Credit Corporation (CCC) program administered by the Farm Service Agency (FSA) with the support of other federal and local agencies. Potential project sponsors apply for selection as Biomass Crop Assistance Program (BCAP) project areas.

The 2008 Farm Bill authorizes 3 types of payments under BCAP:

- Establishment payments for up to 75% of cost of establishing an eligible biomass crop for BCAP contract acreage.
- Annual payments to support production for BCAP contract acreage.
- Collection, harvest, storage, and transportation (CHST) payments of up to $45/ton for 2 years for collection, harvest, storage, and transportation of eligible material to a biomass conversion facility from BCAP contract acreage and other sources.

Although the program is not required to disburse a specified annual amount, the law authorizes USDA to use, from CCC funds, "sums as are necessary" to successfully implement BCAP. The office of Management and Budget in consultation with USDA will decide funding apportionments based upon demand for the program, administration priorities, and other considerations.

Eligibility, Uses, and Restrictions

Biomass production must occur on either agricultural land or non-industrial private forest land and excludes federal and State owned land, Conservation Reserve Program, and similar land protection programs and native sod.

BCAP project areas are selected based on:

- A description of the eligible land and eligible crops of each producer that will participate in the proposed BCAP project area;
- A letter of commitment from a biomass conversion facility that the facility will use eligible crops intended to be produced in the proposed BCAP project area;
- Evidence that the biomass conversion facility has sufficient equity available if the facility is not operational at the time the project area proposal is submitted;
- Other appropriate information.

Contract terms are up to 5 years for annual and perennial crops and up to 15 years for woody biomass crops. USDA will determine whether project proposals meet the minimum threshold for selection based on criteria in the statue and rank proposals based on nine general criteria listed.

Eligible biomass crops do not include those crops eligible for **commodity payments** under Title I of the 2008 Farm Bill, invasive or noxious plants, animal waste and byproducts, food and yard waste, or algae.

Conservation Plans or Forest Stewardship plans must be adhered to by BCAP participants, who also must be in compliance with the highly erodible and wetlands compliance provisions of the Food Security Act of 1985, as amended.

USDA had not yet published the Federal Rules to implement the program by the time this directory was published. Additional uses of CCC funds for this program are currently unknown.

Website

www.fsa.usda.gov/FSA/webapp?area=home&subject=ener&topic=bcap

Contact Information

Paul Harte, USDA/FSA/CEPD-KC
(816) 926-6014
Paul.harte@kcc.usda.gov

2. Forest Biomass for Energy (FBE)

http://attra.ncat.org/guide/a_m/fbe.html

Funding projects that support converting biomass into renewable energy

Program Basics

Authorized under section 9012 of the 2008 Farm Bill, the Forest Biomass for Energy provision provides a new competitive research and development program to encourage use of forest biomass for energy. The program will be administered by USDA Forest Service.

Project Examples

As of this printing, the agency has not developed guidelines to implement the program. Thus, it has not disbursed funds for any projects.

Priority project areas include:

1. Developing technology and techniques to use low-value forest biomass—such as byproducts of forest health treatments and hazardous fuels reduction—for energy production;
2. Developing processes to integrate energy production from forest biomass into biorefineries or other existing manufacturing streams;
3. Developing new transportation fuels from forest biomass; and improving growth and yield of trees intended for renewable energy.

Application and Financial Information

Pre-proposals will be used for initial screening, using a peer review panel of scientific and technical experts in the field. Full proposals will be requested from those that are selected in the pre-proposal review. Detailed evaluation criteria will be posted on a Forest Service website. Primary application requirements will include relevance to priorities identified in the announcement for proposals; scientific quality and contribution of the proposed research; evidence of external collaboration; clearly defined outcomes, deliverables, and benefits that can be reported annually; and appropriateness/adequacy of proposed budget.

Awards can be made for multiple-year funding up to three years with second- and third-year funding dependent on available funds. Either multiple- or single-year funding awards can have a no-cost extension up to one year.

The Forest Biomass for Energy program has authorized appropriations of $15 million annually for FY 2009 to 2012. Individual project funding is expected to be in the range of $500,000 to $1,000,000.

Eligibility, Uses, and Restrictions

Priority will be given to projects that: (1) develop technology and techniques to use low-value forest biomass, such as byproducts of forest health treatments and hazardous fuels reduction, for the production of energy; (2) develop processes that integrate production of energy from forest biomass into biorefineries or other existing manufacturing streams; (3) develop new transportation fuels from forest biomass; and (4) improve the growth and yield of trees intended for renewable energy production.

Applicants must be affiliated with Forest Service Research and Development, other Federal agencies, State and local governments, Indian tribes, land-grant colleges and universities, or private entities including for-profit and non-profit organizations.

Contact Information

The principal contact at the U.S. Forest Service is
Marilyn Buford
Phone: (703) 605-5176
mbuford@fs.fed.us

3. USDA Rural Energy Self-Sufficiency Initiative (RESSI)

http://attra.ncat.org/guide/n_z/ressi.html

Enabling rural communities to increase their energy self-sufficiency

Program Summary

Authorized under section 9009 of the 2008 Farm Bill, the Rural Energy Self-Sufficiency Initiative establishes a new program to enable rural communities to increase their energy self-sufficiency. This grant program may be used to conduct community energy assessments, develop and analyze methods for reducing energy use from conventional sources, and develop and install integrated renewable energy systems. Integrated renewable energy systems are defined as community-wide systems that reduce conventional energy use and incorporate renewable energy use. Visit the program website listed below for updates.

Project Examples

As of this printing, the agency has not developed guidelines to implement the program. Thus, it has not disbursed funds for any projects. Program funding is expected to be available in FY 2010.

Application and Financial Information

Authorized appropriations are $5 million annually for FY 2009-12.

Eligibility, Uses, and Restrictions

The highest priority will be given to institutions of higher education or nonprofit foundations of institutions of higher education, Federal, State, or local government agencies, public or private power generation entities, or government entities with responsibility for water or natural resources. Federal cost-share for any grant is limited to 50% of project cost.

Website
www.rurdev.usda.gov/rbs/busp/bprogs.htm

Contact Information
USDA Rural Development
Business Programs, Energy Branch
1400 Independence Ave. SW
Mail Stop 3225
Washington, DC 20250

The principle contact is:
Anthony (Tony) Ashby
(202)720-0661
Anthony.ashby@wdc.usda.gov

4. Conservation Reserve Program

The Conservation Reserve Program (CRP) provides technical and financial assistance to eligible farmers and ranchers to address soil, water, and related natural resource concerns on their lands in an environmentally beneficial and cost-effective manner. The program provides assistance to farmers and ranchers in complying with Federal, State, and tribal environmental laws, and encourages environmental enhancement. The program is funded through the Commodity Credit Corporation (CCC). CRP is administered by the Farm Service Agency, with NRCS providing technical land eligibility determinations, Environmental Benefit Index Scoring, and conservation planning.

The Conservation Reserve Program reduces soil erosion, protects the Nation's ability to produce food and fiber, reduces sedimentation in streams and lakes, improves water quality, establishes wildlife habitat, and enhances forest and wetland resources. It encourages farmers to convert highly erodible cropland or other environmentally sensitive acreage to vegetative cover, such as tame or native grasses, wildlife plantings, trees, filterstrips, or riparian buffers. Farmers receive an annual rental payment for the term of the multi-year contract. Cost sharing is provided to establish the vegetative cover practices.

Farm Service Agency's Conservation Reserve Program:
http://www.fsa.usda.gov/FSA/webapp?area=home&subject=copr&topic=crp

Appendix 4b: State-level: Funding for individual landowners

1. CREP Conservation Reserve Enhancement Program

USDA's Farm Service Agency (FSA) and the State of Vermont have launched a $2 million Conservation Reserve Enhancement Program (CREP) to protect the 490-square-mile Lake Champlain and its tributaries.

Goals

The goals of the Vermont CREP are to:

- Reduce phosphorus loading to Lake Champlain by 48.3 tons per year.
- Enhance wildlife and aquatic habitat.

Fact Sheet:
http://www.fsa.usda.gov/pas/publications/facts/html/crepvt01.htm

2. Vermont Clean and Clear

Vermont's Clean and Clear Action Plan is a stream stability program that was established in 2009 to help stabilize the state's rivers and streams by reducing erosion and sediment formation. The program was designed to protect river corridors and stream banks particularly during events of flooding. Significant portions of the funding for the Clean and Clear plan help to improve stream stability in the Lake Champlain Basin. In addition to improving streams, the grant also provides restoration projects and educational initiatives that target landowners, municipalities, consultants and watershed associations. The Clean and Clear Action Plan is supported by state, federal and private funds.

Vermont Clean and Clear
Agency of Natural Resources
103 South Main Street
Waterbury, VT 05671
802-241-3600

anr.state.vt.us

Read more: Federal Stream Erosion Protection Grants | eHow.com
http://www.ehow.com/list_7190709_federal-stream-erosion-protection-grants.html#ixzz13TvjWtwv

3. VT DEC Watershed Grants:

http://www.anr.state.vt.us/forms/WaterShedGrants.aspx

Vermonters have an opportunity to protect and restore watersheds through the Vermont Watershed Grants program. Half of the proceeds derived from the sale of the Vermont Conservation License Plate go towards funding the Vermont Watershed Grants program. The program in turn then distributes grants for local and regional water-related projects in Vermont.

Grant funds are available for water-related projects that:

- Protect or restore fish and wildlife habitats;
- Protect or restore water quality and shorelines;
- Reduce phosphorus loading and/or sedimentation as part of Clean & Clear objectives;
- Enhance recreational use and enjoyment;
- Identify and protect historic and cultural resources;
- Educate people about watershed resources; or
- Monitor fish and wildlife populations and/or water quality.

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